International Journal of Mechanical and Production
Engineering Research and Development (IJMPERD)
ISSN (P): 2249-6890; ISSN (E): 2249-8001
Vol. 8, Issue 1, Feb 2018, 1065-1078

MECHANICAL AND WEAR BEHAVIOUR OF ALUMINIUM METAL MATRIX COMPOSITES REINFORCED WITH DISSIPATE MATERIAL-A REVIEW

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ABSTRACT

Aluminium alloys are important materials, and these are used in different Engineering sectors like automotive, Aerospace, Marine and Electronics. The Mechanical and tribological properties of Aluminium alloys are improved by the addition of commercial reinforcements Al_2O_3, SiC, TiC,SiO2, BN, B_4C, MgO,ZrB_2. The Manufacturing cost of these alloys increases due to commercial reinforcement. The Establishment of Industries increases and these are leaving the dissipate material to the environment, which causes environmental pollution. Now a days, researchers are interested to re-use the dissipate material as a reinforcement to the aluminium alloy, to develop new materials with improved properties and less manufacturing cost. In this paper, Mechanical and wear behaviour of Aluminium Metal matrix composites reinforced with different dissipate material are studied.

***KEYWORDS:** Wear, Commercial Dissipate, Industrial Dissipate & Aluminium Composites*

Received: Dec 22, 2017; **Accepted**: Jan 12, 2018; **Published**: Feb 01, 2018; **Paper Id.**: IJMPERDFEB2018127

Original Article

INTRODUCTION

Aluminium is the most abundant material in the earth. Aluminium alloys are used as a main metal matrix element in the composite materials [1]. Aluminium alloys are used in automotive, marine, aerospace, electronics, defense and sports sectors due to having light in weight, high strength, ductility and corrosion resistance. But, aluminium alloys have low wear resistance. Different reinforcements are added to the aluminium alloys to improve the wear resistance. The reinforcements are added with the aluminium alloy to form Aluminium metal matrix composites. The Aluminium metal matrix composites have high tensile strength, high hardness light in weight and corrosion resistance over the un reinforced aluminium alloys.

The reinforcements added to the Aluminium alloys are three types 1. Synthetic Ceramic reinforcement 2. Indudustrial dissipate materials used as reinforcements and 3. Agro dissipate material used as reinforcement. Synthetic reinforcements are Al_2O_3, Sic, TiC, SiO2, BN, B4C, MgO, ZrB2. These are expensive reinforcements and with limited availability [2-3]. The Manufacturing cost of aluminium alloys reinforced with ceramic reinforcement is high, due to high cost of Ceramic reinforcement. Researchers are focusing on alternate reinforcements. In every country, industrialization increases and all the industries leave the dissipate materials to the environment, and griculture sector also leave the dissipate material to the environment, which may cause environmental pollution and health problems.

Researchers are interested to re-use the dissipate material, as a reinforcement to the Aluminium alloys for reducing the manufacturing cost and reducing the environmental pollution. Some of industrial dissipates used as a reinforcements are Rock dust, Quarry dust,wet grinder stone dust, wet Grinder stone dust, Red mud and Bore sand, Fly

ash. Correspondingingly, some of the agro dissipate materials, to be reused as reinforcement to the aluminium alloys are Bamboo leaf ash, rice husk ash, bagasse ash, palm kernel shell ash, maize stalk ash, corn cob ash, bean shell dissipate[4].

ALLUMINIUM ALLOY-IN EXPENSIVE REINFORCEMENT

Rock Dust

Rock dust is obtained from crushing of rock. It is a dissipate material and it is reused as a reinforcement in fabrication of Aluminium metal matrix composites. The addition of rock dust to the aluminium alloys increases the wear resistance.

Quarry Dust

Quarry dust is obtained from cutting and crushing of rock. It is a dissipate material, and dumping in the air, it may cause air pollution. Now a day's, quarry dust is used for road construction and fabrication of light weight bricks and tiles. It is a dissipate material, and it is reused as a reinforcement in fabrication of Aluminium metal matrix composites. The addition of rock dust to the aluminium alloy(A356) increases the wear resistance and hardness.

Wet Grinder Stone Dust

Wet Grinder stone dust is obtained from processing of Quarry rock. It is a dissipate material and dumping in the environment, it may cause environmental pollution and health problems. Therefore, it can be re-used as a reinforcement in manufacturing of Aluminium Metal matrix composites, to reduce the environmental pollution. The addition of wet grinder stone dust to the Al6063 alloy increases the wear resistance.

Red Mud

Red mud is the dissipate material obtained from the extraction of alumina from its bauxite ore. In India, the bauxite ore available in Odisha, Koraput, and Damanjodi. It is a dissipate materialand dumping in the environment, it may cause environmental pollution. It can be re-used as a reinforcement in manufacturing of Aluminium Metal matrix composites, to reduce the environmental pollution. The addition of Red mud particles increases the wear resistance of pure aluminium.

Bore Sand

Bore Sand is obtained during the bore well making process. It is a dissipate material and dumping in agricultural land or environment, it may cause human health problems like asthma, and environmental pollution. Therefore, it can be re-used as a reinforcement in manufacturing of Aluminium Metal matrix composites, to reduce the environmental pollution and health problems. The addition of Bore sand particles increases the wear resistance.

Silica Sand

Silica Sand is available in river area**.** It is used in the construction field and also, it is used in manufacturing of Aluminium Metal matrix composites as a reinforcement. The addition of Silica sand to the Aluminium alloy increases the wear resistance.

Jute Bast Ash

Jute bast Ash is a solid dissipate, obtained in Juice processing Industries. This is a dissipate material, dumping in the environment, it may cause environmental pollution. Therefore, it can be re used as a reinforcement in manufacturing of

Aluminium Metal matrix composites to reduce the environmental pollution reduce the environmental pollution and health problems. The addition of Jute bast ash increases the wear resistance.

Fly Ash

Fly ash is obtained from thermal power plants. It is solid dissipate material**.** This is used in fabrication of bricks, and also used in fabrication of the Aluminium metal matrix composites as reinforcement. The Addition of Fly ash to the aluminium alloy increases the wear resistance.

LITERATURE REVIEW

Rock Dust as a Reinforcement

Dry sliding wear characterization of AA 6061/rock dust composite" by K. Surya Prakash et al. In this study, AA 6061-rock dust composites are prepared with rock dust particle size 10,20 30 um and mass fraction 5%,10%,15% by stir casting process. The process parameters of Rock dust particle size, Mass fraction of rock dust, applied load, sliding velocity and sliding distance are considered as an influence parameters on wear. Dry sliding wear tests conducted on AA 6061-rock dust composites based on Taguchi orthogonal array L27. Orthogonal array using pin- on –disk wear test carried out using pin-on-disk wear test over a load range of 10-20N and sliding velocity of 2-4 m/s for various sliding distance of 1-2Km. From the results, it is observed that the wear resistance of Aluminium composite decreases with increasing rock dust particle size, due to small size rock dust particles filling the gaps in the composite, and it forms the strong bonding strength, and wear resistance decreases with increasing the mass of rock dust particles, and due to strong bonding strength at 5% rock particles, and it decreases with increasing rock dust particles. As the load and sliding distance increases, the wear resistance increases and it decreases with increasing sliding velocity [5].

Quarry Dust as a Reinforcement

"Effect of Reinforcement of Natural Residue (Quarry Dust) to Enhance the properties of Aluminium Metal Matrix Composites" by M. ramesh, et al. In this study, A-356 alloy reinforced with weight percentage of 0, 5,7.5, and 10 of quarry dust by stir casting process. Dry sliding wear tests conducted on Aluminium metal matrix composites using pin- on –disc wear testing equipment over loads of 19.62, 29.43, 39.24 N and constant sliding speed of 1m/s, and sliding distance 1500m. Mechanical tests conducted on the aluminium metal matrix composites. From the results, it is observed that the hardness and tensile strength of the A356-quary dust composite increases with increasing the weight percentage of quarry dust, due to presence of hard quarry dust particles. The wear resistance of Aluminium metal matrix composites increases with increasing the quarry dust particles, due to strong bonding between the quarry dust and A-356 alloy. The wear of the aluminium metal matrix composites increases with increasing the load from 19.62 to 39.24N [6].

"The effect of applied load on wear behaviour of AA-Quary dust particle composite disc sliding against automobile brake material" by M. ramesh, In this study, A-356 alloy reinforced with 5 weight percentage of quary dust by stir casting process. Dry sliding wear tests conducted on Aluminium metal matrix composites using pin- on –disc wear testing equipment over a loads of 20-60 N and at constant sliding velocity of 0.5 m/s, and sliding distance 500m. The wear rate of Aluminium metal matrix composite was compared with the Gray Cast Iron disk. From the results, it is observed that the wear resistance of the Aluminium Metal matrix composite is more than that of the Gray Cast Iron disc, due to presence of hard quarry dust particles. The wear rate of the Aluminium Metal matrix composite decreases with increasing the load and at higher load, the wear rate of the AMC disc is equal to the Gray cast iron. At constant applied load on AMC disc and

Gray Cast Iron disc, the coefficient of friction of Gray Cast Iron disc is lower than that of the AMC due to presence of graphite. The graphite act as a solid lubricant in Gray Cast Iron [7].

Wet Grinder Stone Dust as a Reinforcement

"Wear behaviour of Aluminium Metal matrix composites prepared from Industrial Dissipate" by L. Francis et.al. In this study, AA 6063 alloy reinforced with weight percentage of 10,20 of wet grinder stone dust by two step stir casting process. In first step, wet grinder stone dust particles preheated for removing the moisture and improving the wettability. AA 6063 metal matrix produced by the addition of preheated wet grinder stone dust to the semi solid state alloy. Dry sliding wear tests conducted on Aluminium metal matrix composites using pin- on –disc wear testing equipment over a load range of 9.81-29.43N at a sliding velocity of 1.57-4.71 m/s for various sliding distance of 1-3Km. The mechanical tests conducted on the AA 6063 metal matrix composites. The results indicate that the hardness,Yield behaviour and strength of the AA 6063 alloy are improved with the addition of wet grinder stone particles due to reason that, wet grinder stone dust possess hard Al_2O_3 particles. The wear resistance of Al 6063 metal matrix composite is more than that of the AA 6063 alloy, due to due to formation of oxide layer by transfer of materials in dry sliding of steel pin surface against the Aluminium metal matrix composites. The oxide layer act as a protective layer. The oxide layer thickness increases by adding more wet grinder stone dust particles, and it enhances the wear resistance of the base matrix [8].

Wet Grinder Stone Dust with Al_2O_3

"Studies on Dry sliding wear behaviour of Aluminium Metal Matrix Composite prepared from Discarded Dissipate Particles" By L. Francis et.al, In this study, three samples are produced by two step stir casting. The samples are first one is AA6063 alloy, Second one is AA 6063 Reinforced with 5wt% of wet grinder stone dust particles and 5wt% of of Al_2O_3. Third one is AA 6063 Reinforced with 5wt% of dissipate tonner particles and 5wt% of Al_2O_3Taguchi, ANOVA, Regression analysis done by using the MINITAB15 statically Software. The results indicate that the wear resistance of AA 6063 alloy improves by the addition of 5wt% of dissipate tonner particles and 5wt% of Al_2O_3. Uniform distribution of reinforcement particles in the composite fabrication and oxide protective layer formation on the surfaces, during wear sliding test. The increase in thickness of oxide layer formation improves wear resistance, it is noticed when sliding speed increases. The wear rate increases with increasing the load and sliding distance. The sliding distance has the most influencing parameter on the wear of Aluminium metal matrix composite [9].

Red Mud as a Reinforcement

"Dry sliding wear behaviour of Aluminium Matrix Composites Using Red Mud an Industrial Dissipate" by Naresh Prasad et al. In this study, Red mud is taken as reinforcement and it is heated up to 400^{o}c in the furnace for removing the moisture content. The preheated 10,15,20 and 30 weight percent of red mud particles added to the Aluminium molten metal in stir casting process. Dry sliding wear tests conducted on Aluminium metal matrix composites using pin- on –disc wear testing equipment over a load range of 9.81-29.43N and sliding speed of 1.57-4.71 m/s for various sliding distance of 1-3Km. The results indicate that the wear resistance of the composites increases by the addition of red mud, by virtue of strong bond across red mud particles and aluminium matrix. The hardness of the pure aluminium improved with addition of red mud particles. The wear rate of aluminium matrix composites decreases with increase in red mud particles at higher load and specific speeds [10].

Red Mud with Tungsten Carbide

" Neelima Devi Chinta et al observed in their study of "Dry Sliding Wear behaviour of Aluminium-Red mud-Tungsten Carbide Hybrid metal matrix composites" that wear resistance of pure aluminium increases with the addition of tungsten carbide and red mud powder, owing to the subsistence of well-built bond among the pure aluminium and reinforcements tungsten carbide, Red mud powder. Red mud is procured from NALCO, then it is graded and milled to 42 nanometres using high energy ball mill, resulting into formation of red mud powder. The red mud powder at 2,4 and 6 Weight percentage are added to Pure aluminium along with 4 Weight percentage of Tungsten carbide. The hybrid metal matrix composites produced by conventional sintering with vacuum as medium. Dry sliding wear tests conducted on Hybrid Metal Matrix composites using pin- on –disc wear testing equipment at a load of 10N and 20N. From the results, it is observed that the wear resistance of pure aluminium increases with the addition of tungsten carbide and red mud powder, due to strong bond between the Pure aluminium and reinforcements tungsten carbide, Red mud powder. The wear resistance improves with increasing the sliding speed of the hybrid metal matrix composite [11].

Bore Sand as a Reinforcement

“Wear Behaviour of analysis of Aluminium Metal Matrix Composites Reinforced with Bore Sand Particles” By B. Velliyangiri et.al In this study, Bore sand obtained while digging bore well. The bore sand particles 10,20 weight percentage added to Al6063 alloy to form AA6063 metal matrix composites. The dry sliding wear tests conducted on metal matrix composites over a load range of 9.81-29.43N and sliding speed of 1.57-4.71 m/s for various sliding distance of 1-3Km. The tensile test and Brinell hardness test conducted on Aluminium metal matrix composites. It is observed from the results that the wear resistance of the Aluminium 6063 alloy increases with the addition of bore sand particles. Both the hardness and tensile strength of the Aluminium 6063 alloy metal matrix composites is more than that of the Aluminium 6063 alloy [12].

Jute Bast Ash as a Reinforcement

Gambo Anthony Victor observed in their work titled “Statistical model to predict dry sliding wear behaviour of Aluminium –Jute bast ash particulate composite produced by stir-casting” that Jute bash ash can taken as a reinforcement and it is obtained from Jute bast powder. Jute bast ash particles is preheated before addition to pure aluminium to make its surfaces oxidized. The pure Aluminium is reinforced with percentage of 5, 10,15 ad 20% Jute bast ash particles by sir casting process. Dry sliding wear tests are conducted on such composites across a load range of 15, 30, 45,60 and 75 N and sliding velocities of 0.4, 0.8, 1.2, 1.6 and 2.0 m/s. for sliding distance of 400, 800, 1200,1600 and 2000m. Using ANOVA, the effect of load, sliding speed, Sliding distance and Jute bast Ash particles on wear of the metal matrix composite were investigated. From those results, it is observed that the wear resistance of aluminium matrix composite decreases with increasing the load, sliding velocity and sliding distance due to reason of thermal softening behaviour of the material. From the ANOVA analysis, it is observed that the load, sliding distance and sliding velocity and Jute bast ash particles are significant parameters causing wear of the Aluminium composites [13].

Bamboo Leaf Ash as a Reinforcement

“Porosity measurement and wear performance of Aluminium Hybrid composites Reinforced with Silica sand and Bamboo leaf Ash” by Bodunrin, et.al. In this study, Silica sand and Bamboo leaf ash are taken as a reinforcement. The Bam leaf ash and Silica sand preheated before addition to AA6063 to improve wettability. Five samples prepared by using

preheated Bamboo leaf ash and silica sand in two step stir casting process. First, sample is Al6063 reinforced with 10 weight percentage of silica sand, Second sample is AA6063 reinforced with 7.5 weight percentage of silica sand and 2.5 weight percentage of Bamboo leaf ash, third sample is AA6063 reinforced with 5.0 weight percentage of silica sand and 5.0 weight percentage of Bamboo leaf ash. Fourth sample is AA6063 reinforced with 2.5 weight percentage of silica sand and 7.5 weight percentage of Bamboo leaf ash. Fifth sample is reinforced with 10 weight percentage of Bamboo leaf ash. Micro hardness tests and abrasive wear tests conducted on above samples. The abrasive tests conducted on the sample at 20 N load and rotating speed of the wheel is 200 rpm. It is observed from the results that the hardness of AA6063 reinforced with 10 wt%. Percentage of Silica sand is more than that of the hardness of the AA6063 reinforced with 10wt% percentage of Bamboo leaf Ash. The Hardness of the AA6063 decreases with the addition of Bamboo leaf ash. The wear resistance of Aluminium hybrid composite decreases with increasing Bamboo leaf Ash. The wear resistance of AA6063 reinforced with 10wt%. Silica sand is more than that of the all the samples [14].

Fly Ash as a Reinforcement

" Influence of fly ash particles on dry sliding wear behaviour of AA6061 aluminium alloy" by J. David Raja Selvan. In this study, AA 6061 alloy reinforced with weight percentage of 0,4.8, 12 of Fly ash dust by compo casting process. The dry sliding wear tests are conducted on metal matrix composites and alloy without reinforcement over a load range of 4.9, 9.8, 14.7, 19.6 and 24.5 N and sliding velocity of 1.57 m/s for constant sliding distance of 4000m. It is observed from the results that the wear resistance of the AA6061 alloy increases with the addition of flyash particles and also, it in turn improves the hardness of the AA6061 alloy. At 24.5 N load, the load bearing capacity metal matrix composite are more than that of the unreinforced AA 6061 alloy. The wear resistance of the Aluminium metal matrix composite decreases with increasing of applied normal load [15].

"Dry Sliding Friction and Wear studies of Fly Ash Reinforced AA 6351 Metal Matrix Composites" by M. Uthayakumar et.al observed from their studies that AA 6351 alloy reinforced with 5, 10,15 weight percentages of flyash by stir casting process. The dry sliding wear tests are conducted on metal matrix composites and unreinforced alloy over a load range of 9.81, 19.62, 29.43N and sliding speed of 1, 2,3 m/s for constant sliding distance of 3000m. Using ANOVA, the effect of load, sliding speed and flyash particles on wear of the metal matrix composite were anysed. From the results, it is observed that the wear resistance of the AA6351 alloy improved with the addition of fly ash particles. The minimum wear rate occurred at 5% reinforcement. The wear rate of the AA6351 Metal matrix composite decreases with increasing the load from 9.81N to 19.62N and further, it increases with increase in the load from 19.62 to 29.43N. The wear rate of AA6351 Metal matrix composite decreases with increase in the sliding speed from 1 m/s to 3 m/s. From ANOVA analysis, it is observed that the load has the most influence parameter on wear rate. The load contribute 49.71%, Sliding speed contribute 30.43% and flyash contribute 11.89% on wear of the AA6351 Metal matrix composite [16].

"Dry Sliding Wear Characteristics of flyash reinforced AA2024 Based Stir Cast Composites" by Shivaprakash. Y. M et.al. In this study, AA 2024 alloy reinforced with weight percentage of 2.5, 5,7.5, 10 and 15% of flyash by motorized stir casting process. The dry sliding wear tests conducted on metal matrix composites over a load range of 10,25 and 35N and speed of 200, 300,400 rpm and track diameters of 60,70 and 80mm. From the results, it is observed that the wear resistance of the AA2024 alloy improved with the addition of fly ash particles due to hard fly ash particles, and it increases the hardness of the alloy. The wear resistance of the Aluminium metal matrix composite increase with increasing the fly ash particles from 2 to 10 Wt.% and further, it is decreases. The wear rate of the Aluminium metal matrix composite

increases with increase in the load from 10N to 35N [17].

"Fabrication and study of sliding wear behaviour of Aluminium(AA5083) with Fly Ash Composite Material" by Ranjeet Kumar Singh. In this study, AA 5083 alloy reinforced with weight percentage of 0,4 and 8 % of Fly Ash by stir casting process. The dry sliding wear tests conducted on metal matrix composites and unreinforced alloy over a load range of 5,15 and 25 N and at sliding velocity of 1.047,2.094 and 3.140 m/s. From the results, it is observed that the wear resistance increases with the addition of Fly ash to AA 5083 Alloy. The wear rate of the Un reinforced AA 5083 alloy is more than that of the Reinforced alloy. The wear rate decreases with increasing the load from 5 to 15 N, and it increases on further load increment. The wear resistance decreases with increasing the sliding velocity from 1.047 to 3.140 m/s [18].

"Analysis of Dry Sliding Wear Behaviour of Aluminium –Fly Ash Composite: The Taguchi Approach", by Shanmughasundaram Palanisamy et al. In this study, 99.5% of pure aluminium is reinforced with weight percentage of 10,15 and 20 % of Fly Ash by stir casting process. The dry sliding wear tests conducted on metal matrix composites and over a load range of 5,10 and 15 N and at sliding velocity of 0.5, 0.75 and 1.0 m/s. The effect of Fly Ash, Load, Sliding velocity on wear of the metal matrix composite were investigated using ANOVA analysis and taguchi technique. From the results, it observed that the wear resistance of pure aluminium increases with the addition of Fly Ash particles. The wear rate of the un reinforced pure aluminium is more than that of the reinforced pure aluminium due to hardness of the Fly ash particles. The wear rate of the aluminium metal matrix composite increases with increasing the load from 5 to 15 N. The wear rate of the aluminium metal matrix composite decreases with increasing the sliding velocity. From the ANOVA results, the fly Ash is the most dominating factor on wear on aluminium metal matrix composite, followed by load and sliding velocity[19].

"Wear of Aluminium Metal Matrix Composites - A Review" by Kurapati et.al. observed that the addition of flyash reinforcement in Aluminium increases the wear resistance, but decreases the corrosion resistance[20]. It is further observed that heat treated flyash alond with reinforcement SiC contribute wear resiatance to aluminium 2024 alloy[21].

Table 1: Effect of Reinforcement and Wear Parameters

Sl. No	Investigators	Matrix	Dispersoids	Remarks	Ref
1	K. Soorya Prakash, et.al	AA 6061	rock dust particle size 10,20 30 um and mass fraction 5%,10%,15%	1. Wear resistance increases and it is decreases with increasing the mass of rock dust particles. 2. Wear resistance increases with increasing load and sliding distance. and it is decreases with increasing sliding speed	[5]
2	M. ramesh, et al	A-356 alloy	5,7.5, 10 Weight percentage of Quarry dust particles.	1. Hardness and tensile strength increases 2. wear resistance improved and it is increases with increasing the load.	[6]
3	M. ramesh, et al	A-356 alloy	5 Weight percentage of Quarry dust particles. Gray cast iron disk	1. wear resistance Aluminium metal matrix composite more than that of Gray cast iron disk increasing the load.	[7]
4	L. Francis et.al	AA 6063 alloy	10,20 Weight percentage of wet grinder stone dust particles	1. Hardness and tensile strength increases 2. The wear resistance increases	[8]

Table 1: Contd.,

5.	L. Francis et.al,	AA 6063 alloy	1.5wt% of wet grinder stone dust particles and 5wt% of Al2O3 2.5wt% of dissipate tonner particles and 5wt% of Al2O3	1. The wear resistance increases. 2. The wear resistance increases with increasing sliding speed and it is decreases with increasing load and sliding distance.	[9]
6	Naresh Prasad et al.	Pure Aluminium	10, 15,20 and 30 weight percent of red mud particles	1. Hardness increases 2. Wear resistance improved. 3. Wear rate decreases at higher loads and specific speeds 1. wear rate decreases	[10]
7	Neelima Devi Chinta et al.	Pure Aluminium	2,4 and 6 Weight percentage of red mud particles along with 4 Weight percentage of Tungsten Carbide	1. Wear resistance increases 2. Wear resistance increases with increasing speed of rotation	[11]
8	Mr. B. Velliyangiri et.al	AA 6063	10,20 weight percentage of bore sand particles	1. The hardness and tensile strength increase. 2. Wear resistance increases	[12]
9	Gambo Anthony VICTOR	Pure Aluminium	5, 10,15 and 20 weight percentage of Jute bast Ash	1. The wear resistance increases. 2. The wear resistance decreases with increasing sliding velocity, load and sliding distance.	[13]
10	BODUNRIN	AA 6063 alloy	1.10wt.% of Silica sand 2. 7.5wt% of Silica sand particles and 2.5wt.% of Bamboo leaf ash 3. 2.5wt% of Silica sand particles and 7.5wt.% of Bamboo leaf ash 4. 5 wt% of Silica sand particles and 5wt.% of Bamboo leaf ash 5..10wt.% of Bamboo leaf Ash	1. The Hardness of the Al6063 decreases with the addition of Bamboo leaf ash 2. The wear resistance of Al6063-10wt%. Silica sand is more than that of the all the samples	[14]
11	J. David Raja Selvan	AA 6061	0, 4,8 weight percentage of Fly Ash	1. Hardness increases 2. The wear resistance increases	[15]
12	M. Uthaya kumar	AA 6351	5, 10,15 weight percentage of Fly Ash	1. Wear resistance increases 2. The wear resistance decreases with increasing sliding speed and load.	[16]
13	Shivaprakash. Y. M	AA 2024	2.5, 5,7.5, 10 and 15% of Fly Ash	1. Hardness increases 2. Wear resistance improved 3. The wear resistance decreases with increasing load	[17]
14	Ranjeet Kumar Singh	AA 5083	4,8% of Fly Ash	1. Wear resistance improved 2. The wear rate increases with increasing the load 3. The wear resistance decreases with increasing the sliding velocity	[18]
15	Shanmughasundaram Palanisamy	Pure Aluminium	10,15 and 20 % of Fly Ash	1. Wear resistance improved 2. The wear rate increases with increasing the load 3. The wear resistance increases with increasing the sliding velocity	[19]

Table 2: Mechanical Properties of Aluminium Metal Matrix Composites

Alloy	Reinforcement	Reinforcement (wt%)	Mechanical Propreties		Ref
			Brinell Hardnes(BHN)s	Tensile Strength(Mpa)	
AA6063	0	0	43	131	[8]
	WSD	10%	63	154	
	WSD	20%	75	165	
AA6063	0	0	40	132	[12]
	Bore sand	10%	65	153	
	Bore sand	20%	74	168	
AA6063	Silica sand	10%	64.6		[14]
	Silica sand and Bamboo Leaf Ash	7.5% and 2.5%	59.86		
	Silica sand and Bamboo Leaf Ash	5.0% and 5.0%	53.28		
	Silica sand and Bamboo Leaf Ash	2.5% and 7.5%	52.24		
	Bamboo Leaf Ash	10%	50.44		

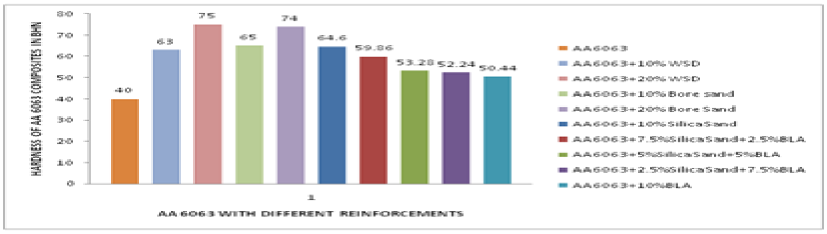

Figure 1: Brinell Hardness Number

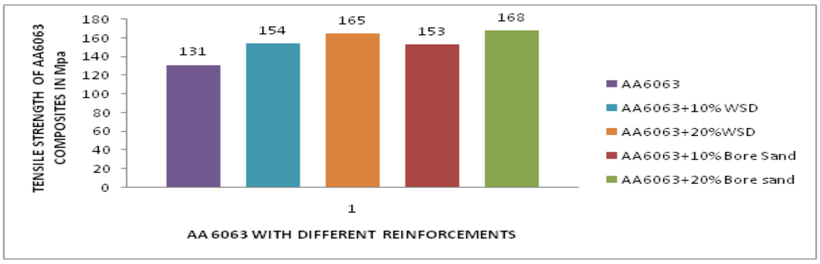

Figure 2: Tensile Strength

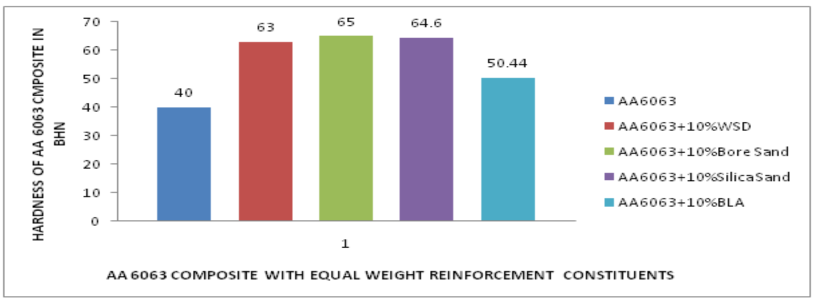

Figure 3: Brinell Hardness Number of AA 6063 Reinforced with Different Reinforcements

Table 3: Optimum Reinforcement and Wear Parameters

Alloy	Reinforcement	Reinforcement Material wt %		Influence Parameters						Ref
		Range	Optimum	Load(N)		Sliding Velocity (ms^{-1})		Sliding Distance(m)		
				Value	Optimum Value	Value	Optimum Value	Value	Optimum Value	
AA6061	Rock dust	5 to 15	15	10 to 30	30	2 to 4	2	1000 to 3000	3	[5]
A356	Quary dust particles	5,7.5, 10	10	19.62, 29.43, 39.24	19.62	1		1500		[6]
A356	Quary dust particles	5	10	20-60N	60	0.5		500		[7]
AA6063	Wet grinder stone dust	10,20	20	9.81, 19.62, 29.43		1.57, 3.14, 4.71	1.57	1000, 2000, 3000	1000	[8]
AA6063	Wet grinder stone dust and Al2O3	5+5		9.81, 19.62, 29.43	9.81	1.5, 3.0, 4.5	1.57	1000, 2000, 3000	1000	[9]
	Dissipate Tonner particles and Al2O3	5+5		9.81, 19.62, 29.43	9.81	1.5, 3.0, 4.5	4.5	1000, 2000, 3000	1000	[9]
Pure Aluminium	Red Mud	10, 15, 20,30	30	9.81, 19.62, 29.43	9.81	1.57, 3.14, 4.71	1.57	1000, 2000, 3000	1000	[10]
Pure Aluminium	Remud+Constant Tungston carbide	(2, 4,6) +4	(6)+4	10,20	10					[11]
AA6063	Bore Sand	10,20	20	9.81, 19.62, 29.43	9.81	1.57, 3.14, 4.71	1.57	1000, 2000, 3000	1000	[12]
Pure Aluminium	Jute bash Ash	5, 10, 15,20	20	15, 30, 45,60 and 75	15	0.4, 0.8, 1.2,1.6 and 2.0	0.4	400, 800, 1200, 1600 and 2000	400	[13]
AA6063	Silica sand (silica, sand+Bamboo leaf Ash), Baboo leaf Ash	10, (7.5+2.5, 5.0+5.0),10	10 % silica sand	10						[14]

Table 3: Contd.,

AA6061	Fly Ash	4, 8,12	12	4.9, 9.8, 14.7, 19.6, 24.5	4.9	1.57		4000		[15]
AA6351	Fly Ash	5, 10,15	15	9.81, 19.62, 29.43	9.81	1, 2,3	3	3000		[16]
AA2024	Fly Ash	2.5, 5,7.5, 10 and 15	15	10, 15,35	10					[17]
AA5083	Fly Ash	4,8	8	5, 15,25	15	1.047, 2.094, 3.140	1.047			[18]
Pure Alumini um	Fly Ash	10,15 and 20	20	5, 10, 15	5	0.5, 0.75 and 1	1			[19]

CONCLUSIONS

- Exhaustive Literature Survey presented.
- The dissipate materials like Rock Dust, Quarry dust, Wet grinder stone dust, Red mud, Bore sand, Jute bast Ash and Bamboo leaf Ash are used as reinforcement to the aluminium alloys.
- From table 1, the addition of Rock Dust, Quarry dust, Wet grinder stone dust, Red mud, Bore sand, Jute bast Ash and Bamboo leaf Ash, Fly Ash to the aluminium alloys, the wear resistance increases.
- From Figure 1 and table 2, the hardness of the AA6063 alloy increases with the addition of Wet grinder stone dust, Bore sand, Silica sand and Bamboo Leaf Ash.
- From figures 2 and table 2, the tensile strength of the AA6063 alloy increases with the addition of Wet grinder stone dust and Bore sand.
- An optimum wear parameters was tabulated in table 3 where the wear rate is minimum
- From Figure 3, the hardness of the AA6063 alloy reinforced Bore sand more than that of the Reinforced with Wet grinder stone dust,silica sand and Bamboo leaf ash

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